

## General

### Title

Pneumonia: hospital 30-day, all-cause, unplanned risk-standardized readmission rate (RSRR) following pneumonia hospitalization.

### Source(s)

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 condition-specific measures updates and specifications report: hospital-level 30-day risk-standardized readmission measures. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017 Mar. 112 p.

## Measure Domain

### Primary Measure Domain

Related Health Care Delivery Measures: Use of Services

### Secondary Measure Domain

Does not apply to this measure

## Brief Abstract

### Description

This measure estimates a hospital-level 30-day risk-standardized readmission rate (RSRR) for patients discharged from the hospital with either a principal discharge diagnosis of pneumonia or a principle discharge diagnosis of sepsis with a secondary discharge diagnosis of pneumonia. The outcome is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission. A specified set of planned readmissions do not count as readmissions.

The Centers for Medicare & Medicaid Services (CMS) annually reports the measure for individuals who are 65 years and older and are Medicare Fee-for-Service (FFS) beneficiaries hospitalized in non-federal short-term acute care hospitals (including Indian Health Services hospitals) and critical access hospitals.

### Rationale

Readmission of patients who were recently discharged after hospitalization with pneumonia represents an important, expensive, and often preventable adverse outcome. The risk of readmission can be modified by the quality and type of care provided to these patients. Improving readmission rates is the joint responsibility of hospitals and clinicians. Measuring readmission will create incentives to invest in interventions to improve hospital care, better assess the readiness of patients for discharge, and facilitate transitions to outpatient status.

## Evidence for Rationale

Yale University/Yale-New Haven Hospital-Center for Outcomes Research & Evaluation (Yale-CORE). Hospital 30-day pneumonia readmission measure: methodology. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2008 Jun 9. 49 p. [22 references]

## Primary Health Components

Pneumonia; 30-day readmission rate

## Denominator Description

The measure cohort consists of admissions for Medicare Fee-for-Service (FFS) beneficiaries aged 65 years and older and discharged from non-federal acute care hospitals and critical access hospitals, having a principal discharge diagnosis of pneumonia (including aspiration pneumonia) or a principal discharge diagnosis of sepsis (not including severe sepsis) that have a secondary discharge diagnosis of pneumonia (including aspiration pneumonia) coded as present on admission (POA) and no secondary diagnosis of severe sepsis coded as POA.

The risk-standardized readmission rate (RSRR) is calculated as the ratio of the number of "predicted" readmissions to the number of "expected" readmissions at a given hospital, multiplied by the national observed readmission rate. For each hospital, the denominator is the number of readmissions expected based on the nation's performance with that hospital's case-mix.

See the related "Denominator Inclusions/Exclusions" field.

Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, this field is used to define the measure cohort.

See the [2017 Condition-specific Measures Updates and Specifications Report: Hospital-level 30-day Risk-standardized Readmission Measures](#) for more details.

## Numerator Description

The measure assesses unplanned readmissions to an acute care hospital, from any cause, within 30 days from the date of a discharge from an index pneumonia admission.

The risk-standardized readmission rate (RSRR) is calculated as the ratio of the number of "predicted" readmissions to the number of "expected" readmissions at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted based on the hospital's performance with its observed case-mix.

See the related "Numerator Inclusions/Exclusions" field.

Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, this field is used to define the measure cohort.

See the [2017 Condition-specific Measures Updates and Specifications Report: Hospital-level 30-day Risk-standardized Readmission Measures](#) for more details.

# Evidence Supporting the Measure

## Type of Evidence Supporting the Criterion of Quality for the Measure

One or more research studies published in a National Library of Medicine (NLM) indexed, peer-reviewed journal

## Additional Information Supporting Need for the Measure

In 2007, the Medicare Payment Advisory Commission (MedPAC) (2007) called for hospital-specific public reporting of readmission rates, and identified pneumonia as a priority condition. In 2010, pneumonia is the principal discharge diagnosis for more than 1 million hospitalizations each year in the United States (Lindenauer et al., 2012; Centers for Disease Control and Prevention [CDC], 2017). From 2003 to 2004, approximately 20% of pneumonia patients were rehospitalized within thirty days, representing the second-highest proportion of all rehospitalizations at 6.3% (Jencks et al., 2009). Among patients 65 years [of age] or older in the United States, pneumonia is the second leading cause of hospitalization (Fry et al., 2005), and based on 2005 Medicare data, MedPAC estimated that about 8.9% of Medicare pneumonia admissions were followed by a readmission within 15 days, accounting for more than 74,000 admissions at a cost of \$533 million.

Pneumonia readmission is a costly event and represents an undesirable outcome of care from the patient's perspective, and highly disparate pneumonia readmission rates among hospitals suggest there is room for improvement (MedPAC, 2007; Lindenauer et al., 2010). Although many current hospital interventions are known to decrease the risk of readmission within 30 days of hospital discharge (Leppin et al., 2014), current process-based performance measures, cannot capture all the ways that care within the hospital might influence outcomes. Measurement of patient outcomes allows for a comprehensive view of quality of care that reflects complex aspects of care such as communication between providers and coordinated transitions to the outpatient environment. These aspects are critical to patient outcomes, and are more broad than what can be captured by individual process-of-care measures.

The pneumonia hospital-specific risk-standardized readmission rate (RSRR) measure is thus intended to inform quality-of-care improvement efforts, as individual process-based performance measures cannot encompass all the complex and critical aspects of care within a hospital that contribute to patient outcomes. As a result, many stakeholders, including patient organizations, are interested in outcomes measures that allow patients and providers to assess relative outcomes performance for hospitals (Bratzler, Nsa, & Houck, 2007).

Numerous studies have demonstrated that appropriate (guideline recommended care), high-quality and timely treatment for pneumonia patients can reduce the risk of readmission within 30 days of hospital discharge (Leppin et al., 2014; Hansen et al., 2011). Recent evidence of declining readmission rates provides further support for the concept that care processes during and following hospitalization can affect a patient's risk of readmission (Lee et al., 2014).

## Evidence for Additional Information Supporting Need for the Measure

Bratzler DW, Nsa W, Houck PM. Performance measures for pneumonia: are they valuable, and are process measures adequate?. *Curr Opin Infect Dis.* 2007 Apr;20(2):182-9. [PubMed](#)

Centers for Disease Control and Prevention (CDC). FastStats: pneumonia. [internet]. Atlanta (GA): Centers for Disease Control and Prevention (CDC); 2017 Jan 20 [accessed 2017 Dec 01].

Fry AM, Shay DK, Holman RC, Curns AT, Anderson LJ. Trends in hospitalizations for pneumonia among

persons aged 65 years or older in the United States, 1988-2002. JAMA. 2005 Dec 7;294(21):2712-9. [PubMed](#)

Hansen LO, Young RS, Hinami K, Leung A, Williams MV. Interventions to reduce 30-day rehospitalization: a systematic review. Ann Intern Med. 2011 Oct 18;155(8):520-8. [PubMed](#)

Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. N Engl J Med. 2009 Apr 2;360(14):1418-28. [PubMed](#)

Lee JS, Nsa W, Hausmann LR, Trivedi AN, Bratzler DW, Auden D, Mor MK, Baus K, Larbi FM, Fine MJ. Quality of care for elderly patients hospitalized for pneumonia in the United States, 2006 to 2010. JAMA Intern Med. 2014 Nov;174(11):1806-14. [PubMed](#)

Leppin AL, Gionfriddo MR, Kessler M, Brito JP, Mair FS, Gallacher K, Wang Z, Erwin PJ, Sylvester T, Boehmer K, Ting HH, Murad MH, Shippee ND, Montori VM. Preventing 30-day hospital readmissions: a systematic review and meta-analysis of randomized trials. JAMA Intern Med. 2014 Jul;174(7):1095-107. [PubMed](#)

Lindenauer PK, Bernheim SM, Grady JN, Lin Z, Wang Y, Wang Y, Merrill AR, Han LF, Rapp MT, Drye EE, Normand SL, Krumholz HM. The performance of US hospitals as reflected in risk-standardized 30-day mortality and readmission rates for Medicare beneficiaries with pneumonia. J Hosp Med. 2010 Jul-Aug;5(6):E12-8. [PubMed](#)

Lindenauer PK, Lagu T, Shieh MS, Pekow PS, Rothberg MB. Association of diagnostic coding with trends in hospitalizations and mortality of patients with pneumonia, 2003-2009. JAMA. 2012 Apr 4;307(13):1405-13. [PubMed](#)

Medicare Payment Advisory Commission (MedPAC). Report to the Congress: promoting greater efficiency in Medicare. Washington (DC): Medicare Payment Advisory Commission (MedPAC); 2007 Jun. 277 p.

## Extent of Measure Testing

### Assessment of Updated Models

The pneumonia readmission measure estimates hospital-specific 30-day all-cause risk-standardized readmission rates (RSRRs) using a hierarchical logistic regression model. Refer to Section 2 in the original measure documentation for a summary of the measure methodology and model risk-adjustment variables. Refer to prior methodology and technical reports for further details.

The Centers for Medicare & Medicaid Services (CMS) evaluated and validated the performance of the models using July 2013 to June 2016 data for the 2017 reporting period. They also evaluated the stability of the risk-adjustment model over the three-year measurement period by examining the model variable frequencies, model coefficients, and the performance of the risk-adjustment model in each year.

CMS assessed logistic regression model performance in terms of discriminant ability for each year of data and for the three-year combined period. They computed two summary statistics to assess model performance: the predictive ability and the area under the receiver operating characteristic (ROC) curve (c-statistic). CMS also computed between-hospital variance for each year of data and for the three-year combined period. If there were no systematic differences between hospitals, the between-hospital variance would be zero.

The results of these analyses are presented in Section 4.5 of the original measure documentation.

### Pneumonia Readmission 2017 Model Results

## Frequency of Pneumonia Model Variables

CMS examined the change in the frequencies of clinical and demographic variables. Frequencies of model variables were stable over the measurement period. The largest changes in the frequencies (those greater than 2% absolute change) include:

Increases in Asthma (11.2% to 14.5%), Respiratory arrest; cardio-respiratory failure and shock (25.7% to 28.0%), Other psychiatric disorders (24.0% to 26.5%), and Septicemia, sepsis, systemic inflammatory response syndrome/shock (13.9% to 16.2%)

A decrease in Iron deficiency or other/unspecified anemias and blood disease (60.7% to 58.5%)

## Pneumonia Model Parameters and Performance

Table 4.5.2 in the original measure documentation shows hierarchical logistic regression model variable coefficients by individual year and for the combined three-year dataset. Table 4.5.3 in the original measure documentation shows the risk-adjusted odds ratios (ORs) and 95% confidence intervals for the pneumonia readmission model by individual year and for the combined three-year dataset. Overall, the variable effect sizes were relatively constant across years. In addition, model performance was stable over the three-year time period; the c-statistic increased slightly from 0.63 to 0.64.

Refer to the original measure documentation for additional information.

## Evidence for Extent of Measure Testing

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 condition-specific measures updates and specifications report: hospital-level 30-day risk-standardized readmission measures. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017 Mar. 112 p.

## State of Use of the Measure

### State of Use

Current routine use

### Current Use

not defined yet

## Application of the Measure in its Current Use

### Measurement Setting

Hospital Inpatient

### Professionals Involved in Delivery of Health Services

not defined yet

## Least Aggregated Level of Services Delivery Addressed

Single Health Care Delivery or Public Health Organizations

## Statement of Acceptable Minimum Sample Size

Does not apply to this measure

## Target Population Age

Age greater than or equal to 65 years

## Target Population Gender

Either male or female

## National Strategy for Quality Improvement in Health Care

## National Quality Strategy Priority

## Institute of Medicine (IOM) National Health Care Quality Report Categories

### IOM Care Need

Not within an IOM Care Need

### IOM Domain

Not within an IOM Domain

## Data Collection for the Measure

### Case Finding Period

Discharges July 1, 2013 through June 30, 2016

### Denominator Sampling Frame

Patients associated with provider

### Denominator (Index) Event or Characteristic

Clinical Condition

Institutionalization

Patient/Individual (Consumer) Characteristic

## Denominator Time Window

not defined yet

## Denominator Inclusions/Exclusions

### Inclusions

An *index admission* is the hospitalization to which the readmission outcome is attributed and includes admissions for patients:

Having a principal discharge diagnosis of:

Pneumonia\* (including aspiration pneumonia); or,

Sepsis\*\* (not including severe sepsis) with a secondary diagnosis of pneumonia (including aspiration pneumonia) coded as present on admission (POA) and no secondary diagnosis of severe sepsis coded as POA

Enrolled in Medicare Fee-for-Service (FFS) Part A and Part B for the 12 months prior to the date of admission, and enrolled in Part A during the index admission

Aged 65 or over

Discharged alive from a non-federal short-term acute care hospital

Not transferred to another acute care facility

\*International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) codes used to define the pneumonia cohort for discharges on or after October 1, 2015:

A48.1 Legionnaires' disease  
J10.00 Influenza due to other identified influenza virus with unspecified type of pneumonia  
J10.01 Influenza due to other identified influenza virus with the same other identified influenza virus pneumonia  
J10.08 Influenza due to other identified influenza virus with other specified pneumonia  
J11.00 Influenza due to unidentified influenza virus with unspecified type of pneumonia  
J11.08 Influenza due to unidentified influenza virus with specified pneumonia  
J12.0 Adenoviral pneumonia  
J12.1 Respiratory syncytial virus pneumonia  
J12.2 Parainfluenza virus pneumonia  
J12.3 Human metapneumovirus pneumonia  
J12.81 Pneumonia due to SARS-associated coronavirus  
J12.89 Other viral pneumonia  
J12.9 Viral pneumonia, unspecified  
J13 Pneumonia due to Streptococcus pneumoniae  
J14 Pneumonia due to Hemophilus influenzae  
J15.0 Pneumonia due to Klebsiella pneumoniae  
J15.1 Pneumonia due to Pseudomonas  
J15.20 Pneumonia due to staphylococcus, unspecified  
J15.211 Pneumonia due to Methicillin susceptible Staphylococcus aureus  
J15.212 Pneumonia due to Methicillin resistant Staphylococcus aureus  
J15.29 Pneumonia due to other staphylococcus  
J15.3 Pneumonia due to streptococcus, group B  
J15.4 Pneumonia due to other streptococci  
J15.5 Pneumonia due to Escherichia coli  
J15.6 Pneumonia due to other aerobic Gram-negative bacteria  
J15.7 Pneumonia due to Mycoplasma pneumoniae  
J15.8 Pneumonia due to other specified bacteria  
J15.9 Unspecified bacterial pneumonia  
J16.0 Chlamydial pneumonia  
J16.8 Pneumonia due to other specified infectious organisms  
J18.0 Bronchopneumonia, unspecified organism  
J18.1 Lobar pneumonia, unspecified organism  
J18.8 Other pneumonia, unspecified organism  
J18.9 Pneumonia, unspecified organism  
J69.0 Pneumonitis due to inhalation of food and vomit

\*\*Principal discharge diagnosis codes included in cohort if combined with a secondary diagnosis of pneumonia coded as POA AND no secondary diagnosis of severe sepsis (R65.20 Severe sepsis without septic shock or R65.21 Severe sepsis with septic shock) coded as POA is present:

A02.1 Salmonella sepsis  
 A22.7 Anthrax sepsis  
 A26.7 Erysipelothrix sepsis  
 A32.7 Listerial sepsis  
 A40.0 Sepsis due to streptococcus, group A  
 A40.1 Sepsis due to streptococcus, group B  
 A40.3 Sepsis due to Streptococcus pneumoniae  
 A40.8 Other streptococcal sepsis  
 A40.9 Streptococcal sepsis, unspecified  
 A41.01 Sepsis due to Methicillin susceptible Staphylococcus aureus  
 A41.02 Sepsis due to Methicillin resistant Staphylococcus aureus  
 A41.1 Sepsis due to other specified staphylococcus  
 A41.2 Sepsis due to unspecified staphylococcus  
 A41.3 Sepsis due to Hemophilus influenzae  
 A41.4 Sepsis due to anaerobes  
 A41.50 Gram-negative sepsis, unspecified  
 A41.51 Sepsis due to Escherichia coli (E. coli)  
 A41.52 Sepsis due to Pseudomonas  
 A41.53 Sepsis due to Serratia  
 A41.59 Other Gram-negative sepsis  
 A41.81 Sepsis due to Enterococcus  
 A41.89 Other specified sepsis  
 A41.9 Sepsis, unspecified organism  
 A42.7 Actinomycotic sepsis  
 A54.86 Gonococcal sepsis  
 B37.7 Candidal sepsis

Note: International Classification of Diseases, Ninth Revision (ICD-9) code lists for discharges prior to October 1, 2015 can be found in the [2016 Condition-specific Measures Updates and Specifications Report: Hospital-Level 30-Day Risk-Standardized Readmission Measures](#)

## Exclusions

Without at least 30 days of post-discharge enrollment in Medicare FFS  
 Discharged against medical advice  
 Pneumonia admissions within 30 days of discharge from a prior pneumonia index admission

## Exclusions/Exceptions

not defined yet

## Numerator Inclusions/Exclusions

### Inclusions

The measure assesses unplanned readmissions, from any cause, within 30 days from the date of discharge from an index pneumonia admission.

If a patient has more than one unplanned admission within 30 days of discharge from the index admission, only the first is considered a readmission. The measures assess a dichotomous yes or no outcome of whether each admitted patient has any unplanned readmission within 30 days. If the first readmission after discharge is planned, any subsequent unplanned readmission is not considered in the outcome for that index admission because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.

The risk-standardized readmission rate (RSRR) is calculated as the ratio of the number of "predicted" readmissions to the number of "expected" readmissions at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted based on the hospital's performance with its observed case-mix.

Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, this field is used to define the outcome.

See the [2017 Condition-specific Measures Updates and Specifications Report: Hospital-level 30-day Risk-standardized Readmission Measures](#) for more details.

## Exclusions



Admissions identified as planned by the planned readmissions algorithm are not counted as readmissions. The planned readmission algorithm is a set of criteria for classifying readmissions and planned among the general Medicare population using Medicare administrative claims data. The algorithm identified admissions that are typically planned and may occur within 30 days of discharge from the hospital.

The planned readmission algorithm has three fundamental principles:

A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/immunotherapy, rehabilitation);

Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and

Admissions for acute illness or for complications of care are never planned

The planned readmission algorithm uses a flow chart and four tables of specific procedure categories and discharge diagnosis categories to classify readmissions as planned. The flow chart and tables are available in the [2017 Condition-specific Measures Updates and Specifications Report: Hospital-level 30-day Risk-standardized Readmission Measures](#) .

## Numerator Search Strategy

Institutionalization

## Data Source

Administrative clinical data

## Type of Health State

Proxy for Outcome

## Instruments Used and/or Associated with the Measure

Planned Readmission Algorithm Version 4.0 (ICD-10) Flowchart

## Computation of the Measure

## Measure Specifies Disaggregation

Does not apply to this measure

## Scoring

Rate/Proportion

## Interpretation of Score

Desired value is a lower score

## Allowance for Patient or Population Factors

not defined yet

## Description of Allowance for Patient or Population Factors

### Risk-Adjustment Variables

In order to account for differences in case mix among hospitals, the measure adjusts for variables (for example, age, comorbid diseases, and indicators of patient frailty) that are clinically relevant and have relationships with the outcome. For each patient, risk-adjustment variables are obtained from inpatient, outpatient, and physician Medicare administrative claims data extending 12 months prior to, and including, the index admission.

The measure adjusts for case mix differences among hospitals based on the clinical status of the patient at the time of the index admission. Accordingly, only comorbidities that convey information about the patient at that time or in the 12 months prior, and not complications that arise during the course of the hospitalization, are included in the risk adjustment.

The measure does not adjust for socioeconomic status (SES) because the association between SES and health outcomes can be due, in part, to differences in the quality of health care that groups of patients with varying SES receive. The intent is for the measures to adjust for patient demographic and clinical characteristics while illuminating important quality differences. As part of the National Quality Forum (NQF) endorsement process for this measure, the Centers for Medicare & Medicaid Services (CMS) completed analyses for the two-year Sociodemographic Trial Period. Although univariate analyses found that the patient-level observed (unadjusted) readmission rates are higher for dual-eligible patients (for patients living in lower Agency for Healthcare Research and Quality [AHRQ] SES Index census block groups) and African-American patients compared with all other patients, analyses in the context of a multivariable model demonstrated that the effect size of these variables was small, and that the c-statistics for the models are similar with and without the addition of these variables.

Refer to Appendix D of the original measure documentation for the list of comorbidity risk-adjustment variables and the list of complications that are excluded from risk adjustment if they occur only during the index admission.

## Standard of Comparison

not defined yet

## Identifying Information

### Original Title

Hospital-level 30-day RSRR following pneumonia.

### Measure Collection Name

National Hospital Inpatient Quality Measures

### Measure Set Name

Readmission Measures

## Submitter

Centers for Medicare & Medicaid Services - Federal Government Agency [U.S.]

## Developer

Centers for Medicare & Medicaid Services - Federal Government Agency [U.S.]

Yale-New Haven Health Services Corporation/Center for Outcomes Research and Evaluation under contract to Centers for Medicare & Medicaid Services - Academic Affiliated Research Institute

## Funding Source(s)

Centers for Medicare & Medicaid Services (CMS)

## Composition of the Group that Developed the Measure

This measure was developed by a team of experts:

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## Financial Disclosures/Other Potential Conflicts of Interest

None

## Endorser

National Quality Forum - None

## NQF Number

not defined yet

## Date of Endorsement

2016 Dec 9

## Measure Initiative(s)

Hospital Compare

Hospital Inpatient Quality Reporting Program

## Adaptation

This measure was not adapted from another source.

## Date of Most Current Version in NQMC

2017 Mar

## Measure Maintenance

Annual

## Date of Next Anticipated Revision

2018 Apr

## Measure Status

This is the current release of the measure.

This measure updates a previous version: Specifications manual for national hospital inpatient quality measures, version 5.0b. Centers for Medicare & Medicaid Services (CMS), The Joint Commission; Effective 2015 Oct 1. various p.

## Measure Availability

Source available from the [QualityNet Web site](#) .

Check the QualityNet Web site regularly for the most recent version of the specifications manual and for the applicable dates of discharge.

## Companion Documents

The following are available:

Hospital compare: a quality tool provided by Medicare. [internet]. Washington (DC): U.S. Department of Health and Human Services; [accessed 2017 Oct 30]. Available from the [Medicare Web site](#) .

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 Medicare hospital quality chartbook. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017. Available from the [Centers for Medicare & Medicaid Services \(CMS\) Web site](#) .

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 condition-specific readmission measures updates and specifications report: supplemental ICD-10 code lists for use with claims for discharges on or after October 1, 2015. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017. Available from the [QualityNet Web site](#) .

## NQMC Status

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## Production

## Source(s)

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 condition-specific measures updates and specifications report: hospital-level 30-day risk-standardized readmission measures. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017 Mar. 112 p.

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